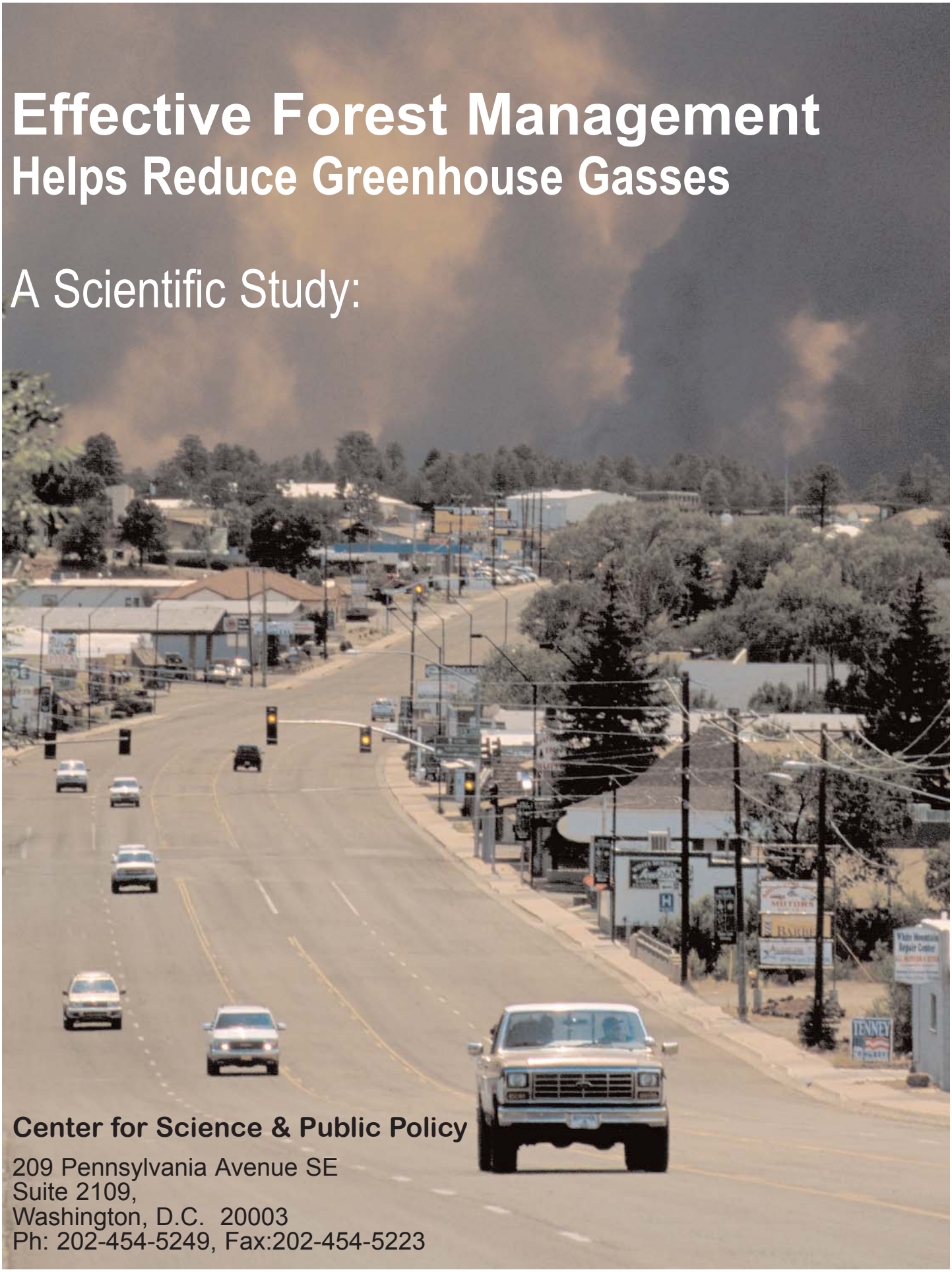
Effective Forest Management
Helps Reduce Greenhouse Gasses

A Scientific Study:



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Effective forest management of fuel loads helps to reduce mercury and greenhouse gas emissions

A growing body of scientific research shows that wildfire, both in the U.S. and worldwide, affects the air quality and water quality in a significantly adverse way. Environmental concerns include the release of the greenhouse gases carbon dioxide (CO_2), carbon monoxide (CO) and methane (CH_4) plus mercury (Hg) emission. Current data persuasively suggest that high intensity forest fires fueled by unnatural forest conditions - as experienced in the Western United States in 2000 and 2002 - may emit globally significant amounts of carbon dioxide, carbon monoxide, methane and mercury. In addition, high intensity fires seriously degrade air and water quality by the emission of substantial amounts of reactive chlorine, lead and arsenic. Mitigating the hazardous fuel conditions by reducing fuel loads that support high intensity wildfires would significantly reduce those emissions.

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Greenhouse gas release - Worldwide biomass burning is estimated to contribute up to 50%, 40% and 16% of the annual human-made emission of carbon monoxide, carbon dioxide and methane. Two large burnings occurred in 1994/95 and 1997/98 , related to dry conditions in some regions during active periods of the El Niño in the equatorial Pacific Oceans. The ranges of estimates of carbon emitted from those burns are 0.6-3.5 (for 1994/95) and 0.8-3.7 (for 1997/98) gigatons. Compared to the total of 6 - 7 gigatons of carbon emitted per year from human activities, biomass burning is a significant source of carbon to the atmosphere.

U.S. scientists recently estimated that the 2002 large fires in the Colorado's Hayman and Missionary Ridge, which burned more than 200,000 acres, emitted significant amounts of carbon dioxide. One of the authors of this new study reported that the 2002 Colorado fires "released about 5 million tons of CO_2 into the atmosphere [and that] is equal to all the CO_2 released by cars and trucks in Colorado during the entire year."

Intense wildfires fueled by decades of forest biomass buildup discharge highly concentrated amounts of greenhouse gas emissions and air pollutants. Anecdotally, air quality conditions surrounding the Colorado fires were degraded so markedly that they appear to have caused one athsma related death.

Lead, arsenic and reactive chlorine - Ben Alexander, a co-chair of the statewide post-fires water quality monitoring program committee of the Colorado Water Quality Monitoring Council, reported, "Preliminary monitoring results from samples of runoff from one of the Colorado fires of 2002 demonstrates that lead and arsenic are being transported from the burned areas into the runoff receiving streams and reservoirs. For the entire period of analytical record neither of these substances was measurably present in the water prior to the fires."

Worldwide biomass burning may also a major source of reactive chlorine (Cl) that participates actively in the chemical cycles of air pollution. Researchers concluded that biomass burning "appears to be the single largest, known source of atmospheric CH_3Cl [methyl chloride; estimated to contribute about 640,000 tons of Cl per year] and a major source of inorganic Cl in many continental regions."

The heavy discharge of such water and air pollutants by wildfires intensified by unsafe buildup of forest biomass could be reduced by adequate fuel load management.

Mercury release - Biomass burnings **(Fig. 1)** are now recognized as an important natural source of mercury emission, comparable to the very large ocean and volcanic emission to the air. Recently, U.S. and Canadian researchers estimated that worldwide burning of vegetation emits about 850 tons of mercury to the air. This amount is about 17 times larger that the total mercury emission estimated for U.S. power plants for 1999 **(Fig. 2)**. The same researchers estimated that the contribution from the North American temperate/boreal forest burning could contribute up to 66 tons of mercury per year.

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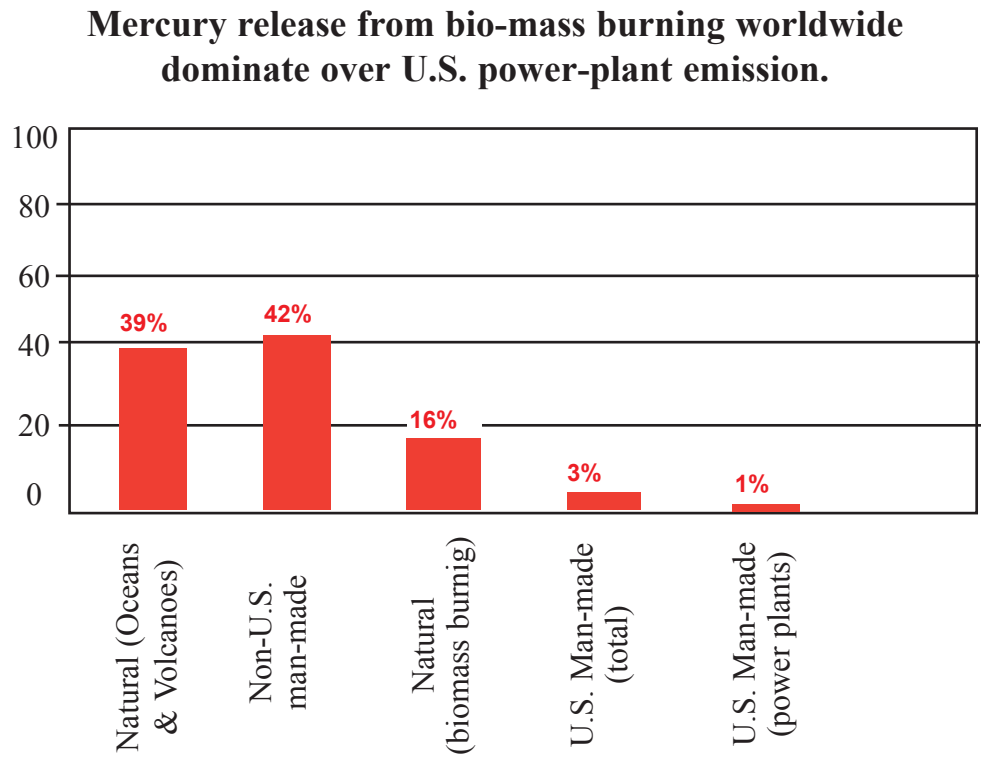

Fig. 1: Biomass burning is a significant emission source of mercury to the air and water. Combined natural sources account for 55% of annual worldwide mercury budget.

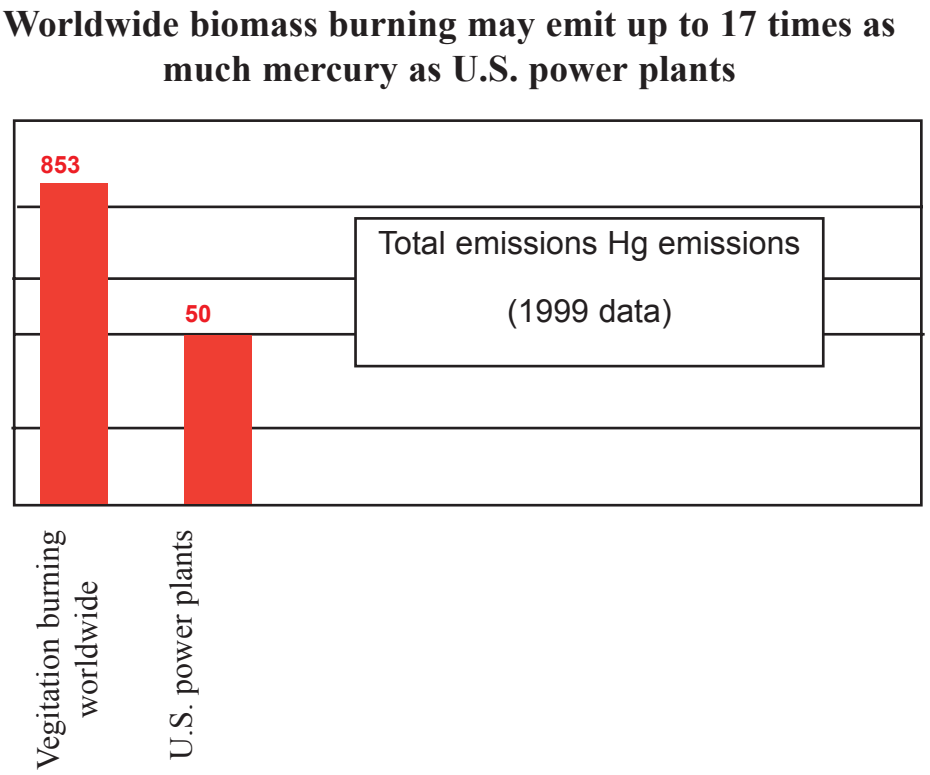

Fig. 2: A recent estimate suggests that worldwide biomass burning emits about 853 tons of mercury and that is 17 times higher than the U.S. power plants emission in 1999.

Independently, a group of South African and German scientists found that mercury emission from biomass burning worldwide could be anywhere from 450 to 1200 tons annually. Another estimate by Brazilian and Canadian researchers also confirmed that the deforestation that occurred during massive forest burnings in the Amazon basin in 1988 (of about 50,000 km2) and 1991 (of about 404,000 km2) most likely emitted about 88 and 710 tons of mercury, respectively, to the airsheds and watersheds.

U.S. wildfires in 2002 (including the boreal forest fires in Alaska) burned about 7.1 million acres (or about 28,500 km2). If the U.S. wildfires released a similar amount of mercury per burned area as the Amazon forest fires did - about 1 ton of Hg per 569 km2 - then 2002 wildfires in the U.S. alone emitted 50 tons of mercury. This number equals the total mercury annual emission from the U.S. coal-fired power plants estimated for 1999, and is larger than the current estimate of 41 tons of Hg per year from U.S. coal-fired power plants.

The amount of Hg released in U.S. wildfires is approximate, because the amount of mercury released from the forest floor and mineral soils depends on the temperature of the fire -high-temperature fires could release more mercury than less severe fires. Because the fires of 2000 and 2002 in the Western U.S. were particularly intense - as a result of the buildup of forest fuel load - the soil burned deeply and amount of Hg released is probably larger than estimated. Also, such severe fires promote widespread dispersal of Hg by sending pollutants into the upper reaches of the atmosphere.

Proper forest management of hazardous fuel loads would not only preserve critical species and habitat, but also reduce emission of greenhouse gases and mercury, and measurably minimize the release of pollutants like lead and arsenic into watersheds from highly intense wildfires. More research is needed to verify the scope of the inter-relationship between catastrophic wildfire and the discharge of these pollutants into airsheds and watersheds, but scientific analyses to date suggests the connection is substantially negative.

The Center for Science and Public Policy, (202) 454-5249

Langenfelds R.L. et al., "Interannual growth rate variations of atmospheric CO2 and its d13C, H2, CH4 , and CO between 1992 and 1999 linked to biomass burning, " Global Biogeochemical Cycles 16 (no. 3), 1048: 21-1-21-22 (2002).
Page S. E. et al., "The amount of carbon released from peat and forest fires in Indonesia during 1997," Nature 420, 61-65 (2002).
"Forest fires affect global carbon budget," The Forestry Source, Society of American Foresters, February, Vol. 8, No. 2 (2003).
http://www.rockymountainnews.com/drmn/news/article/0,1299,DRMN_3_1650215,00.html (last accessed May 13, 2003).
http://btwatershed.org/Newsletter/Fall2002/Forest%20Fires.htm (last accessed May 13, 2003)
Lobert J. M. et al., "Global chlorine emissions from biomass burning: Reactive chlorine emissions inventory," Journal of Geophysical Research 104, 8373-8389 (1999).
Friedli H.R. et al., "Mercury emissions from burning of biomass from temperate North American forests: laboratory and airborne measurements," Atmospheric Environment 37, 253-267 (2003).
Brunke E.G. et al., "Gaseous mercury emissions from a fire in the Cape Peninsula, South Africa, during January 2000," Geophysical Research Letters 28, 1483-1486 (2001).
Veiga M. M. et al., "Mercury pollution from deforestation, " Nature 368, 816-817 (1994).
http://www.nifc.gov/stats/index.html (last accessed May 13, 2003).
See e.g. this DOE's National Energy Technology Laboratory factsheet: http://www.netl.doe.gov/publications/factsheets/program/prog050.pdf (last accessed May 14, 2003)

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